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54 A process for the preparation of a polybutene having a thioether function.

57 A process for the preparation of a polybutene having a thioether function comprising reacting together, under conditions in which free radicals are generated, (A) an organic thiol of the general formula R-SH and (B) a liquid polybutene having a carbon-carbon double bond per molecule and a number average molecular weight of from 200 to 10,000.

The polybutene having a thioether function obtainable by the process can be used for, or as an intermediate for, manufacturing lubricants, detergents, pesticides or glass modifying agents.

**EP 0 342 792 A1**

## A PROCESS FOR THE PREPARATION OF A POLYBUTENE HAVING A THIOETHER FUNCTION

The present invention relates to a process for the preparation of a polybutene having a thioether function by an addition reaction between an organic thiol and a polybutene containing carbon-carbon double bonds, and to polybutene having a thioether function obtainable by the process. The polybutene having a thioether function is particularly intended to be employed in compositions for lubricants, detergents, emulsifiers, pesticides or agents which modify glass or the surface of glass.

In the field of lubricants a considerable demand has recently appeared to develop a fluid capable of exhibiting both a high viscosity index and a low flow point, defined as being the lowest temperature at which the fluid still flows when it is cooled without stirring under standardized conditions. Furthermore, lubricants capable of being employed at high pressure and having a low degree of evaporation are being sought. It has been found, however, that the majority of lubricants do not satisfy all these requirements and that they cannot be employed in a wide field of applications.

An urgent need has also appeared to develop new compositions for detergents or emulsifiers, particularly products having specially adapted detergent properties for engine oils.

The present invention contributes an appreciable progress, not only in the development of lubricating agents capable of being employed over a wide pressure range, but also of detergent or emulsifying agents capable of being employed as additives for engine oils.

According to the present invention a process for the preparation of a polybutene having a thioether function comprises reacting together, under conditions in which free radicals are generated;

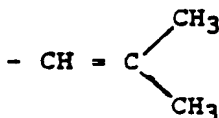
(A) an organic thiol and

(B) a liquid polybutene having a carbon-carbon double bond per molecule and a number average molecular weight of from 200 to 10,000.

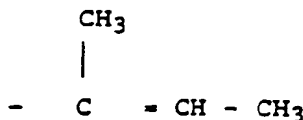
The invention includes a polybutene having a thioether function obtainable by this process.

The polybutene used to obtain the new chemical product is a liquid polybutene prepared by polymerization of 1-butene or of cis and trans 2-butenes, or by copolymerization of 1-butene with cis and trans 2-butenes, especially with the aid of a catalyst of the cationic type. Good results are obtained when use is made of a polybutene prepared by polymerization of isobutene, or by copolymerization of isobutene with 1-butene and/or 2-butenes, with the aid of a catalyst of the cationic type, in particular of the Friedel-Crafts type, such as aluminium trichloride, boron trifluoride, tin or titanium tetrachloride, or a chlorinated organoaluminium derivative, optionally in the presence of a cocatalyst such as hydrochloric acid, tert-butyl chloride or water. The polybutene may be advantageously prepared by copolymerization of a mixture of olefins containing four carbon atoms, particularly a mixture comprising 30 to 90% by weight of isobutene and 10 to 70% by weight of 1-butene and 2-butenes.

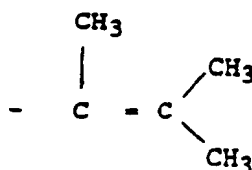
The polybutene employed in the present invention must contain one carbon-carbon double bond per molecule, generally arranged at a chain end. The carbon-carbon double bond may be of a type which is either trisubstituted according to the formulae:



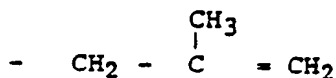
and



or tetrasubstituted according to the formula:



It may also be of the vinylidene type according to the formula:



The polybutene used for preparing the polybutene having a thioether function according to the present invention may contain no carbon-carbon double bonds of the vinyl type. Vinyl type double bonds are known to be the most reactive.

The carbon-carbon double bonds which are present in the polybutene employed in the present invention are advantageously from 1 to 90%, preferably from 40 to 85% and more especially from 50 to 85% of the vinylidene type which are much less reactive than those of the vinyl type.

The polybutene which is suitable for the present invention has, furthermore, a number average molecular weight, measured by osmometry or by gel permeation chromatography, ranging from 200 to 10,000, preferably ranging from 330 to 5000, and more particularly ranging from 400 to 2500. The use of a polybutene of too low a molecular weight results in an addition product of relatively high volatility, while a polybutene of too high a molecular weight results in an addition reaction of low yield.

Thus, the polybutene employed may, on average, contain from 4 to 180, preferably from 6 to 90 and more particularly from 7 to 45 olefin-derived units per molecule. It may consequently contain from 16 to 720 carbon atoms, preferably from 24 to 360 carbon atoms and more particularly from 28 to 180 carbon atoms per molecule.

The polybutene may also have a viscosity ranging from 0.002 to 100 Pa s, preferably from 0.01 to 20 Pa s and more particularly from 0.05 to 5 Pa s at 100° C.

Moreover, the polybutene may have a relatively narrow molecular weight distribution, calculated according to the ratio of the weight average molecular weight, Mw, to the number average molecular weight, Mn, of the polymer. This distribution is between 1 and 5, and preferably between 1 and 3.

The polybutene used in the process of the present invention is a liquid. Liquid polybutenes are very different from the solid thermoplastic or elastomeric polybutenes having very high molecular weights.

By way of example, a polybutene sold by BP Chemicals (Great Britain) under the registered trade mark "Ultravis" may be employed.

According to the present invention, the organic thiol may be chosen from compounds corresponding to the general formula:

R-SH

in which R denotes:

- an alkyl radical containing from 1 to 20 carbon atoms, optionally substituted by one or more aryl radicals, or an aryl radical, in particular a phenyl or naphthyl radical,

- or a pyridyl or pyrimidinyl radical,

- or an alkyl or aryl radical substituted by one or more hydroxyl groups: - OH,

- or an alkyl or aryl radical substituted by one or more carboxyl groups: -CO<sub>2</sub>H,

- or an alkyl or aryl radical substituted by one or more ester groups of formula - CO<sub>2</sub>R<sup>1</sup> in which R<sup>1</sup> denotes an alkyl radical containing from 1 to 6 carbon atoms or an aryl radical,

- or a group of formula

-(CH<sub>2</sub>)<sub>m</sub>(OCHR<sup>2</sup>CH<sub>2</sub>)<sub>n</sub>OR<sup>3</sup>

in which R<sup>2</sup> denotes a hydrogen atom or a methyl radical, R<sup>3</sup> denotes a hydrogen atom or an alkyl radical containing from 1 to 6 carbon atoms, m is an integer ranging from 1 to 6 and n is an integer ranging from 0 to 100,

- or a group of formula

-(CH<sub>2</sub>)<sub>p</sub>Si(R<sup>4</sup>)(R<sup>5</sup>)(R<sup>6</sup>) in which R<sup>4</sup> and R<sup>5</sup> are identical or different and denote a hydrogen atom or an alkyl or alkoxy radical, R<sup>6</sup> denotes an alkyl or alkoxy radical and p is an integer ranging from 2 to 10.

The organic thiol may, in particular, be chosen from the following products:

ethyl mercaptan:	$\text{CH}_3\text{-CH}_2\text{SH}$
propyl mercaptan:	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{SH}$
isopropyl mercaptan:	$\text{CH}_3\text{-CHSH-CH}_3$
butyl mercaptan:	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{CH}_2\text{SH}$
isobutyl mercaptan:	$(\text{CH}_3)_2\text{CH-CH}_2\text{SH}$
thiophenol:	$\text{C}_6\text{H}_5\text{-SH}$
thiocresol:	$\text{CH}_3\text{-C}_6\text{H}_4\text{-SH}$
benzyl mercaptan:	$\text{C}_6\text{H}_5\text{-CH}_2\text{SH}$
thionaphthol:	$\text{C}_{10}\text{H}_7\text{-SH}$
mercaptoethanol:	$\text{HOCH}_2\text{-CH}_2\text{SH}$
mercaptopropanol:	$\text{HOCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$
mercaptobutanol:	$\text{HOCH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{SH}$
alpha-thioglycerol:	$\text{HOCH}_2\text{-CHOH-CH}_2\text{SH}$
thiopyrocatechol:	$\text{HO-C}_6\text{H}_4\text{-SH (ortho)}$
thioresorcinol:	$\text{HO-C}_6\text{H}_4\text{-SH (meta)}$
thiohydroquinone:	$\text{HO-C}_6\text{H}_4\text{-SH (para)}$
thioglycolic acid:	$\text{HOOC-CH}_2\text{SH}$
thiohydracrylic acid:	$\text{HOOC-CH}_2\text{-CH}_2\text{SH}$
thiolactic acid:	$\text{CH}_3\text{-CHSH-COOH}$
thiomalic acid:	$\text{HOOC-CH}_2\text{-CHSH-COOH}$
mercaptobenzoic acid:	$\text{HOOC-C}_6\text{H}_4\text{-SH}$
phenyl ester of mercaptobenzoic acid:	$\text{C}_6\text{H}_5\text{COO-C}_6\text{H}_4\text{-SH}$
mercaptopyridine:	$\text{C}_5\text{H}_5\text{N-SH}$
mercaptopyrimidine:	$\text{C}_4\text{H}_3\text{N}_2\text{-SH}$
2-methoxy-2-ethoxyethanethiol:	$\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{SH}$
3-mercaptopropyltrimethoxysilane:	$(\text{CH}_3\text{O})_3\text{SiCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$
3-mercaptopropyldimethoxy methylsilane:	$(\text{CH}_3\text{O})_2\text{CH}_3\text{SiCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$
and 3-mercaptopropyltriethoxysilane:	$(\text{CH}_3\text{CH}_2\text{O})_3\text{SiCH}_2\text{CH}_2\text{-CH}_2\text{SH}$

The polybutene having a thioether function is obtainable according to the present invention by an addition reaction between the organic thiol and polybutene, under conditions in which free radicals are generated. These conditions can be provided, for example, by the use of free radical generators or of ultraviolet radiation. The invention is based on the surprising discovery that, under these conditions, an organic thiol is capable of reacting with a polybutene which has a relatively high number average molecular weight and which contains one carbon-carbon double bond per molecule. Moreover, since the carbon-carbon double bond of the polybutene is not generally of the vinyl type, they are not considered to be highly reactive.

Furthermore, in contrast to olefins which are generally linear in structure, polybutene is characterized by a relatively branched structure, since it contains one or two ethyl or methyl branches per monomer unit. It is surprisingly found that, in the conditions of the present reaction, the relatively branched structure of polybutene does not give rise to a formation of many by-products through secondary radical reactions.

Free radical generators are well known and, by way of example, there may be mentioned peroxides such as dibenzoyl peroxide, dicyclohexyl peroxydicarbonate, tert-butyl perbenzoate, lauroyl peroxide, isobutyryl peroxide, tert-butyl peroxyacetate and dicumyl peroxide, or else compounds containing an azo group, such as azo-bisisobutyronitrile, or else oxygen, or a mixture of these products. It is also possible to employ photochemical methods using ultraviolet radiation, natural light, optionally in the presence of air or of oxygen. The choice between the photochemical method and the use of free radical generators depends on the nature of the reactants used, in particular on the nature of the organic thiol.

An important factor in the process for preparing the polybutene having a thioether function is the choice of the medium in which the addition reaction takes place. Surprisingly the addition reaction may be carried out without any solvent, that is to say in bulk in the liquid polybutene. Despite the relatively high viscosity of the medium, it is found that, with stirring, the addition reaction takes place with a satisfactory yield. The choice of the medium in which the addition reaction takes place depends on the nature of the polybutene and of the organic thiol. In certain cases the addition reaction may be performed in a solvent suitable for dissolving the polybutene and for raising the activity of the organic thiol. The solvent employed may be chosen from saturated hydrocarbons, aromatic hydrocarbons or halogenated hydrocarbons. For example, toluene, 1,2-dichloroethane or dichloromethane may be employed.

The temperature at which the organic thiol adds most advantageously to polybutene depends on the nature of the reactants, and on the choice of the free radical generators or of the photo-chemical method employed for generating free radicals and of the medium in which the reaction takes place. It is generally between  $-20^{\circ}\text{C}$  and  $+200^{\circ}\text{C}$ , and preferably between  $0^{\circ}\text{C}$  and  $100^{\circ}\text{C}$ . When the addition reaction takes place in the presence of a free radical generator, reaction temperature is related, in particular, to the decomposition temperature of this generator.

Another major factor in the process for preparing the polybutene having a thioether function is the molar proportion of the organic thiol relative to polybutene. It turns out that, despite the relatively high molecular weight of the polybutene and its branched structure, it is possible to use equimolar quantities of polybutene containing one carbon-carbon double bond per molecule and of an organic compound possessing the thiol group. This is one of the surprising features of the invention which produces a highly advantageous result, in that it is possible to add an organic thiol to a molecule of polybutene and thus to be able to functionalize the polybutene molecule. The addition reaction can be carried out with a molar excess of the organic thiol relative to the polybutene containing one carbon-carbon double bond per molecule.

The polybutene having a thioether function obtainable by an addition reaction between polybutene and the organic thiol is a thioether containing, on one side of the sulphur atom the polybutene characterized by a relatively long chain with a branched structure and, on the other side of the sulphur atom, the group R of the organic thiol. The polybutene having a thioether function can be employed as such in compositions for lubricants, detergents, emulsifiers or pesticides. The advantageous properties of the polybutene having a thioether function are chiefly linked with the particular structure of the thioether. In particular, the sulphur element present in the thioether group of the new chemical product of the present invention endows the latter with highly advantageous properties, especially in applications such as an engine oil operating under high pressure.

When, in addition to the  $-\text{SH}$  group, the organic thiol possesses another group capable of subsequently reacting with other products, the addition product may then be prepared as an intermediate product and may be employed to synthesize other molecules which will contain the thioether group. These new molecules may also be employed in compositions for lubricants, detergents, emulsifiers or pesticides.

Thus, by way of example, when the organic thiol additionally contains a hydroxyl group, the addition product obtained according to the present invention is, in this case, a thioether possessing a hydroxyl group capable of reacting in a subsequent stage with an alkylene oxide such as ethylene oxide or propylene oxide. The result is that the addition product obtained in this way consists of a molecule containing a polybutene part and a polyoxyalkylene part on either side of the thio group. A product of this kind can be employed in a lubricating or emulsifying composition. The addition product possessing a hydroxyl group may also be employed to react with a compound containing an isocyanate group, such as methyl isocyanate. In this case, compounds containing a urethane group in addition to a thioether group are obtained. These compounds are capable of being employed in pesticide compositions.

Furthermore, when the organic thiol additionally contains an alkoxysilane group, the addition product obtained according to the present invention may be used for modifying glass or the surface of glass.

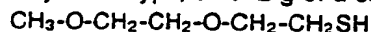
The invention is further illustrated by the following examples.

#### Example 1

0.062 g of azobisisobutyronitrile, 3.8095 g of an "Ultravis" polybutene sold by BP Chemicals (Great Britain), having a number average molecular weight of 930 and one carbon-carbon double bond per molecule, about 52% of which are of the vinylidene type, 0.969 g of mercaptopyrimidine and 20 ml of 1,2-dichloroethane, employed as a solvent, are introduced with stirring into a 100 ml glass round-bottomed flask. The reaction is carried out under an air stream, at a temperature of  $90^{\circ}\text{C}$  for 30 hours. At the end of this time, an orange viscous liquid is recovered. The solvent employed is removed by evaporation and a mixture containing the addition product and residual mercaptopyrimidine in solid form is obtained. 10 ml of toluene are added to this mixture and the addition product is recovered after separation of the residual mercaptopyrimidine by filtration and by evaporating off the toluene. The addition product is analysed by infra-red spectroscopy and it is found that it now contains hardly any carbon-carbon double bonds of the vinylidene type.

#### Example 2

0.8733 g of "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 930 and one carbon-carbon double bond per molecule, about 52% of which are of the vinylidene type, 0.1642 g of a compound of formula



- 5 (2-methoxy-2-ethoxyethanethiol) and 2 ml of dichloromethane, employed as a solvent, are introduced with stirring into a 20 ml quartz round-bottomed flask. The mixture thus obtained is subjected at ambient temperature (20 °C) to an irradiation with ultraviolet radiation. After 12 hours' irradiation the solvent employed is removed by evaporation and a liquid, highly viscous, transparent and yellow-coloured addition product is obtained. This addition product is analysed by infra-red spectroscopy and by proton nuclear  
10 magnetic resonance spectrometry and it is found that it now contains hardly any carbon-carbon double bonds of the vinylidene type.

### Example 3

- 15 5.118 g of a "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 930 and one carbon-carbon double bond per molecule, about 52% of which are of the vinylidene type, 0.662 g of thioglycolic acid ( $\text{HSCH}_2\text{COOH}$ ), 0.0283 g of azobisisobutyronitrile and 4 ml of toluene, employed as a solvent, are introduced with stirring into a 100 ml glass round-bottomed flask. The  
20 reaction is carried out under an air stream, at a temperature of 80 °C for 50 hours. At the end of this time the reaction mixture is cooled to ambient temperature (20 °C). After removal of the solvent employed by evaporation, a highly viscous, transparent and yellow-coloured liquid is obtained. This liquid is analysed by infra-red spectroscopy and by proton nuclear magnetic resonance spectrometry, and it is found that it now  
25 contains hardly any carbon-carbon double bonds of the vinylidene type.

### Example 4

- 30 15.5 g of an "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 930 and one carbon-carbon double bond per molecule, about 52% of which are of the vinylidene type, 1.83 g of mercaptoethanol ( $\text{HSCH}_2\text{CH}_2\text{OH}$ ) and 6 ml of toluene, as a solvent, are introduced into a 50 ml quartz round-bottomed flask. The mixture obtained is subjected at ambient temperature (20 °C) to an irradiation with ultraviolet radiation. After 14 hours' irradiation the solvent  
35 employed and the residual mercaptoethanol are evaporated off, and then an addition product is recovered, which is in the form of a highly viscous transparent and yellow-coloured liquid. This addition product is analysed by infrared spectroscopy and by nuclear magnetic resonance spectrometry and it is found that carbon-carbon double bonds of the vinylidene type have disappeared practically completely.

### Example 5

- 40 5.2136 g of an "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 930 g and one carbon-carbon double bond per molecule, about 52% of which are of the vinylidene type, 1.115 g of mercaptoethanol ( $\text{HSCH}_2\text{CH}_2\text{OH}$ ) and 5 ml of toluene employed as a solvent  
45 are introduced with stirring into a 50 ml glass round-bottomed flask. The addition reaction is carried out under an air stream, at a temperature of 70 °C for 20 hours. At the end of this time the reaction mixture is cooled to ambient temperature (20 °C). After evaporation of the solvent employed and of the residual mercaptoethanol, a highly viscous, transparent and yellow-coloured liquid is recovered. This liquid is analysed by infra-red spectroscopy and it is found, on the one hand, that it now contains hardly any carbon-  
50 carbon double bonds of the vinylidene type and, on the other hand, that it contains hydroxyl groups.

### Example 6

- 55 This example is intended to show a use of the polybutene having a thioether function produced according to the present invention. 100 g of an addition product obtained according to Example 4, 200 g of isooctane, as a solvent, and 0.02 mole of potassium hydroxide are introduced into a one-litre stainless steel reactor equipped with stirring system rotating at 200 revolutions per minute and a heating and cooling

device. The reactor is then heated to 100 °C for one hour. After returning to ambient temperature (20 °C) by the application of vacuum, the solvent and all the water present in the reactor are evaporated off. After this evaporation stage, 200 g of perfectly anhydrous isooctane are added to the reactor as a solvent. The reactor is then placed under a nitrogen atmosphere and is heated to 150 °C, and 120 g of ethylene oxide are introduced into it in the course of 4 hours so that the temperature of the reaction medium does not exceed 153 °C. At the end of this time, the reactor is cooled to ambient temperature (20 °C) and the gaseous phase present in the reactor, consisting chiefly of nitrogen, is removed. The final product is isolated after evaporation of the isooctane and treatment with 2% by weight of a magnesium silicate sold under the trademark "Ambosol" by Hoescht (Federal Republic of Germany), this treatment being performed with the objective of removing the catalyst residues. The product thus obtained can be employed in a lubricating or emulsifying composition.

#### Example 7

5.15 g of "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 1000 and one carbon-carbon double bond per molecule, about 84% of which are of the vinylidene type, 1 ml of a compound of formula:  
 $(\text{CH}_3\text{O})_3\text{SiCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$   
 (3-mercaptopropyltrimethoxysilane) and 8 ml of toluene, employed as a solvent, are introduced with stirring into a quartz round-bottomed flask. The mixture thus obtained is subjected at ambient temperature (20 °C) to irradiation with ultra-violet radiation. After 14 hours irradiation the solvent employed is removed by evaporation and an addition product is obtained.

The addition product is analysed by infra-red spectroscopy and by proton nuclear magnetic resonance spectrometry. It is found that it now contains hardly any carbon-carbon double bonds of the vinylidene type, and that it contains groups of formula:  $\text{CH}_2\text{-S-CH}_2$  and  $\text{Si}(\text{OCH}_3)_3$

#### Example 8

4.95 g of "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 1000 and one carbon-carbon double bond per molecule, about 84% of which are of the vinylidene type, 0.6 ml of a compound of formula:  
 $(\text{CH}_3\text{O})_2\text{CH}_3\text{SiCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$

(3-mercaptopropyltrimethoxysilane) and 5 ml of toluene, employed as a solvent, are introduced with stirring into a quartz round-bottomed flask. The mixture thus obtained is subjected at ambient temperature (20 °C) to an irradiation with ultra-violet radiation. After 17 hours' irradiation the solvent employed is removed by evaporation and an addition product is obtained.

The addition product is analysed by infra-red spectroscopy and by proton nuclear magnetic resonance spectrometry. It is found that it now contains less than 50% of the carbon-carbon double bonds of the vinylidene type, and that it contains groups of formula:  
 $\text{S-CH}_2\text{-CH}_2\text{-CH}_2\text{-Si}$  and  $\text{CH}_3\text{-Si}$

#### Example 9

5.35 g of "Ultravis" polybutene sold by BP Chemicals (Great Britain) which has a number average molecular weight of 1000 and one carbon-carbon double bond per molecule, about 84% of which are of the vinylidene type, 0.5 ml of a compound of formula:

$(\text{CH}_3\text{CH}_2\text{O})_3\text{SiCH}_2\text{-CH}_2\text{-CH}_2\text{SH}$

(3-mercaptopropyltriethoxysilane),  $6 \times 10^{-3}$  mol of azobisisobutyronitrile and 8 ml of toluene, employed as a solvent, are introduced with stirring into a glass round-bottomed flask. The reaction is carried out under an air stream, at a temperature of 60 °C for 44 hours. At the end of this time, 0.46 ml of 3-mercaptopropyltriethoxysilane are introduced with stirring into the mixture. The reaction is carried on under the same conditions for 74 hours. At the end of this time, the reaction mixture is cooled to ambient temperature (20 °C). After removal of the solvent employed by evaporation, the addition product is obtained.

The addition product is analysed by infra-red spectroscopy and by proton nuclear magnetic resonance spectrometry. It is found that it now contains hardly any carbon-carbon double bonds of the vinylidene type,

and that it contains bonds of formula:  
Si-O-C

## 5 Claims

1. A process for the preparation of a polybutene having a thioether function comprising reacting together, under conditions in which free radicals are generated;

(A) an organic thiol and

(B) a liquid polybutene having a carbon-carbon double bond per molecule and a number average molecular weight of from 200 to 10,000.

2. A process as claimed in claim 1 in which the polybutene has a number average molecular weight of from 330 to 5000.

3. A process as claimed in claim 1 or claim 2 in which from 40 to 85% of the carbon-carbon double bonds present in the polybutene are of the vinylidene type.

4. A process as claimed in any one of claims 1 to 3 in which the organic thiol has the general formula R-SH in which R represents;

(a) an alkyl radical containing from 1 to 20 carbon atoms which is unsubstituted or substituted by one or more alkyl or aryl radicals

(b) a pyridyl or pyrimidinyl radical

(c) an alkyl or aryl radical substituted by one or more hydroxyl groups

(d) an alkyl or aryl radical substituted by one or more carboxyl groups

(e) an alkyl or aryl radical substituted by one or more ester groups of formula -CO<sub>2</sub>R<sup>1</sup> in which R<sup>1</sup> represents an alkyl radical containing from 1 to 6 carbon atoms or an aryl radical

(f) a group of formula

$-(CH_2)_m (OCH R^2 CH_2)_n OR^3$

in which R<sup>2</sup> represents a hydrogen atom or a methyl radical, R<sup>3</sup> represents a hydrogen atom or an alkyl radical containing from 1 to 6 carbon atoms, m is an integer from 1 to 6 and n is an integer from 1 to 100 or

(g) a group of formula

$-(CH_2)_p Si (R^4)(R^5)(R^6)$

in which R<sup>4</sup> and R<sup>5</sup> are the same or different and represent a hydrogen atom or an alkyl or alkoxy radical, R<sup>6</sup> represents an alkyl or alkoxy radical and p is an integer of from 2 to 10.

5. A process as claimed in any one of claims 1 to 4 in which the reaction is carried out in the absence of a solvent.

6. A process as claimed in any one of claims 1 to 4 in which the reaction is carried out in the presence of a solvent selected from saturated hydrocarbons, aromatic hydrocarbons and halogenated hydrocarbons.

7. A process as claimed in any one of claims 1 to 6 in which at least an equimolar quantity of organic thiol is used relative to the amount of polybutene.

8. A polybutene having a thioether function obtainable by a process as claimed in any one of claims 1 to 7.

9. The use of a polybutene having a thioether function as claimed in claim 8 in compositions for, or as an intermediate product for, manufacturing, lubricants, detergents, emulsifiers, pesticides or agents for modifying glass or the surface of glass.

10. The use of a polybutene having a thioether function, produced according to the process of claim 4 in which the organic thiol has the general formula R-SH in which R is an alkyl or aryl radical substituted by one or more hydroxyl groups, to form a reaction product by reaction with an alkylene oxide or a compound containing an isocyanate group.





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number

EP 89 30 3743

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
2	X FR-A-1 551 894 (JAPANESE GEON) * Summary; examples C, G *	1-10	C 08 F 8/34
3	X GB-A-2 110 706 (ANIC) * Claims 1-19 *	1-10	
2	A GB-A-2 016 479 (BP CHEMICALS) * Claim 1; page 1, lines 5-19 *	1	
2	A BE-A- 656 258 (VEREINIGTE GLANZSTOFF-FABRIKEN) * Claims 1-3 *	1	
1	A EP-A-0 249 102 (BAYER) * Claims 1, 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			C 08 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21-07-1989	Examiner PERMENTIER W.A.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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